in regard to electricity a hundred and forty years ago, and among these were the attracting power of points for an electric spark, and the conducting power of metals. Lightning-rods were therefore introduced with the idea that the electricity existing in the lightning-discharge could be conveyed around the building which it was proposed to protect, and that the building would thus be saved.

The question as to the dissipation of the energy involved was entirely ignored, naturally; and from that time to this, in spite of the best endeavors of those interested, lightning-rods constructed in accordance with Franklin's principle have not furnished satisfactory protection. The reason for this is apparent when it is considered that this electrical energy existing in the atmosphere before the discharge, or, more exactly, in the column of dielectric from the cloud to the earth, reaches its maximum value on the surface of the conductors that chance to be within the column of dielectric; so that the greatest display of energy will be on the surface of the very lightning-rods that were meant to protect, and damage results, as so often proves to be the case. The very existence of such a mass of metal as an old lightning-rod only tends to produce a disastrous dissipation of electrical energy upon its surface,—"to draw the lightning," as it is so commonly put.

Having cleared our minds, therefore, of any idea of conducting electricity, and keeping clearly in view the fact that in providing protection against lightning we must furnish some means by which the electrical energy may be harmlessly dissipated, it seems clear why it is that the use of sufficient energy to dissipate a pound of copper, leaves not enough to do harm to other objects around. The question naturally arises how much energy there is available. There is stored up in each cubic centimetre of the column of dielectric from the cloud to the earth, just before the lightning-discharge, an amount of electrical energy given by the expression $\frac{1}{8\pi} K E^2$, where K is the specific inductive capacity of the dielectric, and E the electromotive intensity, both in electrostatic units. This expression is given on p. 156, Vol. I., second edition, of Maxwell's "Treatise on Electricity and Magnetism." Substituting the values of K and E, and reducing, we find that the amount of energy involved amounts very nearly to one foot-pound for each cubic foot of air. This is, of course, a maximum value.

When this amount of energy is reached in any cubic foot, the air breaks down, and the discharge takes place, and the amount of energy per cubic foot in the column of dielectric reaching from the cloud to the earth cannot be uniform, but must reach this maximum value along a central core, and diminish gradually from this value to nothing at a considerable distance. If we consider that the dissipation of this electrical energy takes place throughout the whole length of the column of dielectric from the cloud to the earth, we shall see that all the energy that we have to care for in our lightning-rod is that existing in the section of the column contained between two surfaces passing through the top and foundation of our house respectively. I have said two surfaces, as doubtless they are not planes: presumably they are two equi-potential surfaces.

I am now coming to a point that I want to make clear, and that is, that, according to the usually accepted theories of electrical action, this electrical energy is gradually stored up in the column of dielectric from the cloud to the earth, and that it is distributed in this column with the greatest amount per cubic foot along some central core, this amount not exceeding one foot-pound per cubic foot, and that this process can be continued until the stress is so great that the air breaks down, when what we call a discharge of lightning takes place, and the electrical energy disappears, of course only to take on some other form. You may say that the electricity travels from the cloud to the earth, or from the earth to the cloud, whichever you please; at any rate, there is an electrical action in a vertical direction, the discharge being supposed vertical. I will ask, however, whether it is not true that the energy involved travels along the equi-potential lines; that is, travels in the main horizontally. It seems to me that it shrinks in, as it were, from the considerable column or ellipsoid of dielectric upon the central core, where it manifests itself as heat and light in the electrical flash. It will, then, be clear how it is that in providing a body upon which the dissipation of energy shall take place we have to guard against something not coming from above or below, but coming from the side, and that this may be the explanation of why it is that, so far as I have been able to find, a dissipatable conductor protects the building between two essentially plane surfaces passing through its upper and lower ends.

Have we not, then, in the lightning-discharge, another illustration of the relation between light and electricity? If we suppose for a moment that in place of the central core where the electrical energy is dissipated we were to place some hot or luminous body, this body would constantly radiate energy into the surrounding space, and at any instant there would be in each cubic foot of this surrounding space a certain amount of radiant energy. Now, if this process could be brought to a standstill at any moment, would not the conditions be in some degree similar to those just preceding the electrical discharge? There would be need of a certain force along the central core to maintain the various stresses throughout the surrounding medium; and if this central force were to be taken away, as it is taken away when the dielectric breaks down and the spark passes, the stresses could no longer be maintained, and there would be a vibratory transmission of the energy back upon the central core.

But let all this be as it may, the main point which I would urge upon your consideration is that by giving the electrical energy something which experience shows it will readily dissipate, that is, a conductor of varying resistance and small size, we can but mitigate the effects of lightning-discharges, so long as the conservation of energy holds true. I will only repeat that I have so far found no case on record where the dissipation of such a conductor has failed to protect the building under the conditions already explained.

NOTES AND NEWS.

IN England, says *The Illustrated American*, the only venomous snake is the viper, which frequents chalky districts, and is not to be found all over the country. Perhaps these vipers are the most common and vicious of the smaller snakes, seldom growing longer than two feet. They abound not only in warm countries, where forests are thick and men are few, but also in the coldest regions of Sweden, Norway, Russia, and even Siberia, where a great many exist, owing to a stupid superstition among the peasants that if a viper is killed a terrible misfortune will soon befall the rash slayer. The California viper builds itself a little mud hut, just its own length, and probably half an inch thicker than its own body. It is made of earth, fine gravel, and sometimes leaves are mixed in the construction of this curious abode. It is lined with a soft, silky substance, finer than cotton and silkier than down. At each end there are two little doors, and when *monsieur*

la maitre is half-way in, one shuts, and when all the way in, the other closes, leaving the master of the house as isolated and exclusive as Robinson Crusoe on his desert island. One of these "viper shells," brought from California lately, was so thoroughly sun-baked and hardened that though more than two feet long it could be dropped on the floor without breaking.

— A "security" elevator soon to be introduced is described as follows by a member of the Polytechnic Society of Kentucky: The framework of its hatchway is supplied, at each of the two sides or ends which stand at right angles to the cage entrance, with a pair of wood studs extending from the bottom to the top of the hatchway, and with a space of seven-eighths of an inch between them. Into one of each pair of these studs is casemented a series of horizontally arranged steel bolts ten, or it may be twelve, inches apart. These bolts are movable, and when pushed seven-eighths of an inch outward their ends project across the spaces between the studs; and as long as they remain thus across, nothing, of course, can pass up or down within these spaces. When, however, they are drawn back into their casements, the spaces are vacant, and any thing can ascend or descend through them. The framework of the cage is constructed on a central wrought iron beam, the ends of which project into these spaces. When the cage is at the bottom of the hatchway, the bolts are within their casements; but the instant its central beam passes the two bolts next to it, these, by its movement upwards, and through a device which is as immediate as it is simple and positive, are projected out of their casements across the spaces underneath the beam. When the conductor has reached any point at which he wishes to descend, he lays one of his hands against a button and through a continued pressure brings into action a device similar in nature to the one which, through the movement of the cage upward, pushed the bolts out across those spaces, and through the movement of the cage downward each successive pair of bolts next underneath are drawn back into their casements. Various ingenious devices are introduced to avoid the chance of accidental pressure on the button.

— The separation of magnetic iron-ore from the rock with which it is associated, says *Engineering*, has often been attempted with more or less success. Even if only a part of the rock is eliminated, there is a substantial gain, particularly in cases where the ore has to be transported long distances from the mine to the blast furnace. But if the gangue contain phosphorus or sulphur, as it often does, so long as any appreciable amount of it remains, the iron made from the ore is unfitted for use in the Bessemer process, and sells at a lower price than it would if it had been freed from these impurities. It has therefore been the object of inventors to produce a separator which would remove the rock so effectually that not more than .05 per cent of phosphorus should remain, even when the iron is associated with a gangue of phosphate of lime. The difficulty found was, that immediately the pulverized ore was magnetized all the particles clung together, entangling between them fragments of rock, which could only escape with difficulty, if at all. Various means were tried by vibration and alternate magnetization and demagnetization to permit the rocky particles to get away from the embrace of the metal. Whatever measure of success might be attained in this way, and the results were far from being fully satisfactory, it did not extend to the case of particles formed partly of iron and partly of rock. These were attracted by the magnet and remained with the metal. In the Monarch magnetic ore separator, however, invented by Messrs. Ball and Norton, a very ingenious method has been devised of freeing the rocky particles, and of discriminating between those that are entirely metallic, and partly metallic and partly earthy. The crushed ore is fed on to the surface of a rotating paper drum. Within this drum, and occupying less than half its circumference, is a multipolar magnet, having twelve poles alternately north and south. Immediately the metallic particles touch the drum they become polarized, and hang on by one end. In passing from the first pole to the second of the stationary magnet the opposite pole of each particle is attracted, while that hitherto attracted becomes repelled. Consequently the fragment turns end for end, and in so doing any rock clinging to it has the chance to escape downwards under the action of gravity. This effect is repeated some twelve times. After passing half way round one drum the ore is delivered on to a second, running at a higher speed, and here centrifugal force aids the separation. The same process of turning over the fragments is repeated, and should any of them happen to be partly of rock and partly of iron they are sure to be thrown off and eliminated. The final product is almost entirely of iron, the phosphorus being reduced to .05 per cent.

— "It is, I think, well to record the following observations of the intelligence of the thrush," says John Hoskyns-Abrahall in a letter to *Nature* of April 23. "The first happened on June 28, 1865. I then saw, from the windows that look out on the little lawn north of my house, a thrush steadily 'stepping westward' in front of the hedge that parts the lawn from the public road. The bird seemed to be intentionally making for a gravel path that, after passing almost close to the windows, bends to the north-west, toward the small gate of my front garden. It was bearing something in its bill. On coming to the path it attempted to break this on a stone. It did not succeed. It then tried another stone. This time it succeeded. Thereupon it flew away. On the spot I found a remarkably big stone embedded in the path, and round it were scattered bits of snail shell. The bird had eaten the snail. The second of the observations I would note, and the more striking of the two, happened on June 5, 1890. I then was viewing the gravel path from the westernmost of the four windows. Just beneath me, standing on the path, was a female thrush. She had succeeded in breaking a snail shell. She had the snail in her bill. But, despite of vigorous efforts, she could not swallow it. Up hopped a male thrush. Standing before the female, he opened his bill. She dropped the snail into his bill. He chewed the snail. He dropped it back into the female's ready bill. She swallowed it. The pair blithely trotted off, side by side, toward the small gate. I saw them no more."

— Mr. W. H. Goodyear, writing to the New York *Nation* from Keneh, Upper Egypt, on March 17, says that Mr. Petrie has unearthed at Maydoom "the oldest known Egyptian temple and the only Pyramid temple ever found." Apart from the Temple of the Sphinx at Ghizeh, this building is also "the only temple of the Old Empire so far known." It was buried under about forty feet of rubbish. It lies directly at the centre of the eastern base of the Pyramid, on the side facing which it has two round-topped obelisks. "Obelisks and temple chambers so far entered," says Mr. Goodyear, "have the plain, undecorated style of the Old Empire, as shown by the Temple of the Sphinx, but hieratic inscriptions in black paint found within fix the name of Seneferoo as builder, and confirm the supposition to this effect hitherto based on the fact that tombs near the Pyramid contain his cartouche. Seneferoo is the king connecting the third and fourth dynasties, and variously placed in either. According to computations of Mariette and Brugsch, the antiquity will be about 4000 B.C., or earlier." On Tuesday, March 10, Mr. Petrie's workmen reached a platform which appeared to be a causeway terminating with two obelisks at the base of the Pyramid. "In the forenoon of Wednesday," continues Mr. Goodyear, "a workman came to say that an opening had been found under the platform on the side next the Pyramid. This proved to be the top of a doorway choked by detritus, through which Mr. Petrie crawled into an interior of three chambers and discovered the inscriptions mentioned. I had the pleasure of following him. Mr. Petrie thought the apartments had not been previously entered for about three thousand years — that is to say, that the rubbish fallen from the pyramid had choked the entrance about three thousand years after construction. A friend who was with me noticed on the floor some dried wisps of papyrus, a plant now extinct in Egypt. The chambers thus far found are so filled that one cannot stand erect in them, and a door at the end of the third chamber is blocked by large stones. Over all lies an enormous mass of detritus, whose removal by Arab diggers is now in progress. I had the pleasure next day of carrying the news of Mr. Petrie's find to the gentlemen of the Egypt Exploration Fund at Beni-Hassan, and of witnessing their unaffected delight over it."

— The United States Hydrographic Office reports that this month, for the first time in several years, there is not a single obstruction along the coast that is dangerous to sea-going vessels, thanks to the work of the United States Steamship "Yantic," in command of Commander C. H. Rockwell, U.S.N. The last wreck destroyed was the schooner "Ada P. Gould," near Cape Charles light-ship, April 11 and 12, and a final visit was paid on April 24 to the scene of the collision between the "Vizcaya" and "Hargraves," off Barnegat. The "Yantic" has been engaged in this work for seventy-six days, of which thirty-six were spent at sea. She has steamed and sailed about 3,000 miles and has anchored in the open sea, in various depths along the coast, twenty-two times. Six wrecks have been destroyed, one has been dismantled, and a permanent danger mark erected; many spars have been blown up and set adrift, and five wrecks have been sought for with care and reported as no longer existing as obstructions. Thirty-three service torpedoes and seven exercise torpedoes have been expended in the work, and no casualties or accidents of any kind have occurred. The following is an extract from Commander Rockwell's report: "Officers and crew were carefully instructed and prepared for this hazardous and important duty, and strong wrecking crews were detailed from the best men in the ship for the working boats. There was always danger of staving a boat, and our boats received considerable injury and hard usage in this way, but by practice the men became very expert, and were generally successful in avoiding danger. I take pleasure in commending officers and men for their zeal and earnestness."

— Capt. Petersen, of the Swedish bark "Eleanora," reports to the United States Hydrographic Office that between 7 and 8 P.M., March 13, he experienced a submarine earthquake in the volcanic region of the Atlantic west of St. Paul Rocks. The ship was heading north-west, going about three knots, with a light easterly wind and calm sea, when a noise was heard on the port side, like a heavy surf, and almost immediately the sea began to bubble and boil like a huge kettle, the broken water reaching as high as the poop-deck. No distinct shock was felt, but after the disturbance struck the ship she continued to tremble as long as it lasted. After about an hour it ceased for an hour and was then followed by another similar disturbance. A bubbling sound was all that could be heard and the water appeared foamy, but it was impossible, on account of the darkness, to say whether it was muddy. The next day weather and sea were as usual. Position at 8 P.M., 3° 47′ north latitude, 42° 03′ west longitude. The region from St. Paul Rocks to and including the Windward Islands is especially subject to earthquakes, and reports similar to the above are often received. In September, October, and November of last year a number of shocks were reported, of which the heaviest was the one at Barbadoes on Oct. 6, felt throughout the region between Demerara and Martinique. On Nov. 20, a severe shock was felt about 8° 45′ north latitude, 40° 28′ west longitude, aboard the American bark "P. J. Carleton," Capt. Crosbie. The sea became like a boiling pot, tumbling about in a seething mass and greatly confused, and a grating sensation was experienced, as though the vessel were going over a reef. Nov. 28, in 3° 00′ north latitude, 27° 00′ west longitude, a slight shock was experienced aboard the British ship "Walter H. Wilson," Capt. Sproul.

— John Le Conte, professor of physics at the State University, Berkeley, Cal., died April 29. Dr. Le Conte belonged to a family distinguished for having many members who have been interested in scientific work. He was the son of Lewis Le Conte, known for his contributions to the physical sciences as well as a naturalist, and was born in Liberty County, Ga., in December, 1818. He was graduated at Franklin College of the University of Georgia in 838, and at the New York College of Physicians and Surgeons in 1841. From this city he proceeded to Savannah, where he began the practice of the medical profession, but in 1846 he was called to the chair of Natural Philosophy in Franklin College, which he occupied until 1855. The following year he lectured on chemistry at the New York College of Physicians and Surgeons, and in 1856 he was appointed Professor of Natural and Mechanical Philosophy in South Carolina College, at Columbia, S.C. In 1869 he was appointed Professor of Physics and Industrial Mechanics in the University of California, and discharged the duties of that position until 1881. From 1876 to 1881 he held the office of president of the university in connection with his professorship. At the expiration of that period he retired to the chair of physics, which he occupied until his death. He was a brother of Professor Joseph Le Conte, the geologist.

— Dr. Joseph Leidy died April 19. Dr. Leidy was born in Philadelphia, Sept. 9, 1823. In 1844 he received the degree of doctor of medicine from the University of Pennsylvania, but soon abandoned the practice of his profession for more congenial pursuits. From 1846 to 1852 he gave private lectures on anatomy and physiology. In 1853 he was made professor of anatomy in the University of Pennsylvania, a position in connection with which he did the major part of his scientific work. Aside from his work in anatomy he did much in zoölogy and paleontology. In 1884 Dr. Leidy was made director of the biological department in the university. As an indication of the extent of his investigations it may be mentioned that his papers on biological subjects number more than eight hundred.

— Freiherr von Benko, captain in the Austrian Navy, has published a pamphlet, we learn from the April *Scottish Geographical Magazine*, in which he calls attention to the singular fact that until half a century ago the inhabitants of the Philippines were a day behind those of neighboring countries in their reckoning. It is easy to understand that the time on the meridian opposite to ours must differ by twelve hours, but who shall say whether those twelve hours are to be added or subtracted from our reckoning? Practically this has generally been settled by the first discoverers, according as they sailed eastwards or westwards. Legaspi, the conqueror and colonizer of the Philippines, sailed to the islands from the east, and brought what may be called the eastern date with him. Later on, however, when the Pope divided the world between the Spaniards and the Portuguese, giving the former the half lying beyond a meridian passing 100 leagues west of the Azores (afterwards removed to 370 leagues) the islands, owing to the inability of navigators in those days to calculate the longitude with any approach to accuracy, remained in the hands of the Spaniards, and the date was changed to that of their American possessions. But, in 1844, the governor-general of the Philippines decreed that "considering it convenient that the mode of reckoning days in these islands shall be uniform with that prevailing in Europe, China, and other countries situated to the east of the Cape of Good Hope, . . . I ordain, with the assent of His Excellency the Archbishop, that, for this year only, Tuesday, December 31st, be suppressed, and that the day following Monday the 30th of the same month be styled Wednesday, January 1st, 1845." That the date has been made to conform with that of Eastern countries is a circumstance not generally known, as Freiherr von Benko proves by quotations from geographical authors and encyclopædias, among others Meyer's "Konversation Lexikon."

— So far as is at present known, says *Nature*, the first person who kept a record of the weather was Walter Merle. He did so for the years 1337 to 1344, and his manuscript on the original vellum still exists. Thanks to the courtesy of the officials of the Bodleian Library, Mr. G. J. Symons has had this manuscript photographed, and reproductions of the ten large photographs, with a full translation (the original is in contracted Latin), some particulars as to Merle, and a list of the subscribers, are to be given in a handsomely printed volume. Mr. Symons wishes to call attention to the fact that no one will be able to obtain a copy who does not apply for one before May 1. Except ten copies reserved for subscribers too distant to apply before that date, not a single copy in excess of those subscribed for will be printed.

— Mr. William Beutenmüller has recently been appointed curator of the department of entomology in the American museum of natural history in Central Park, New York City.

— Mr. C. H. Tyler Townsend has just taken the post of entomologist at the agricultural experiment station at Las Cruces, New Mexico.